

WARNING: See GRT Autopilot Installation Manual and Autopilot Checkout Procedure for information on wiring and switch configurations and post-installation testing. This guide details use of the autopilot when a GRT pitch servo, roll servo, engage/disengage switch and external servo power switch are installed.

General Color Coding

Yellow - The AP is not following a navigation source. Examples: Heading Mode (HDG), all Autopilot OFF indications, Vertical Speed or Heading Hold.

Red - Critical labels are red. Examples: AP emergency functions (S&L and 180° turn), GPS signal or glideslope is lost while on approach, missed approach mode without a defined target altitude, pitch suspended (SUSP) and pitch servo disengaged with excessive bank angle.

Green - Labels and bearing pointers associated with GPS navigation

White - Labels and bearing pointers associated with primary VHF radio; VOR, Localizer, or ILS

Cyan - Labels and bearing pointers associated with a secondary VHF radio if installed

Black - Annunciator labels for items that are pending

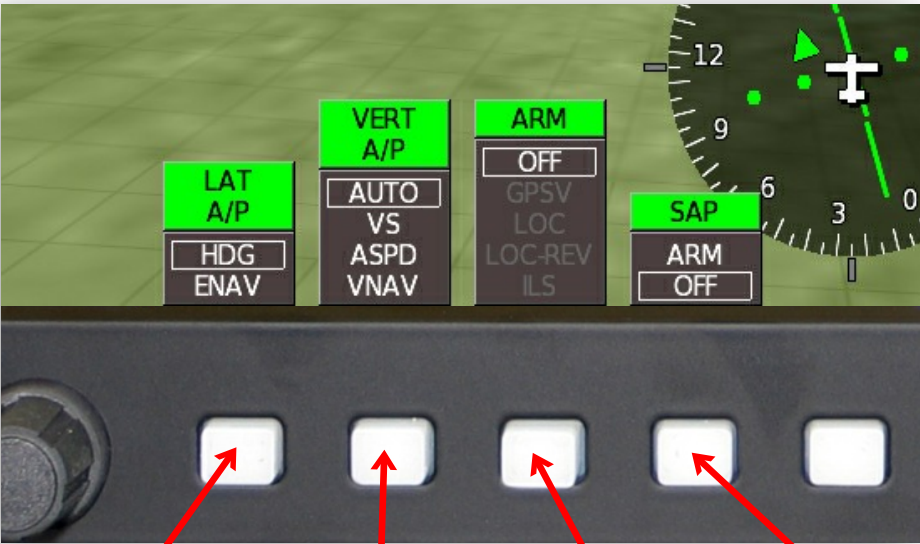
Magenta - GPS course, waypoint balloons

Dark Magenta - Heading bug when coupled to autopilot (HDG mode)



Autopilot navigation and mode softkeys appear across the bottom.

Main Autopilot Control Softkeys- (Press Right Knob to access from HOME screen)




LAT A/P
Lateral Autopilot Modes
Choose what a/p follows laterally
HDG- Heading
ENAV-Electronic Navigation (GPS or VOR/LOC)
GNAV-IFR GPS

VERT A/P
Vertical Autopilot Modes
Choose whether to use Vertical Speed, Airspeed or Vertical Command/Glideslope for climbs/descents

ARM
Select Approach Type
Tells a/p to expect and capture selected approach guidance


SAP
Synthetic Approach
Choose ARM to load SAP. System will then ask for runway selection.



EXIT
Press to go back to HOME softkeys

SEL ALT
Turn knob to set Altitude Bug and Altitude Select box. Push knob to Enter and adjust vertical rate to climb/descend to selected Altitude. (see Second Tier)

Second-Tier Autopilot Control Softkeys- (Press Right Knob TWICE to access from HOME screen)



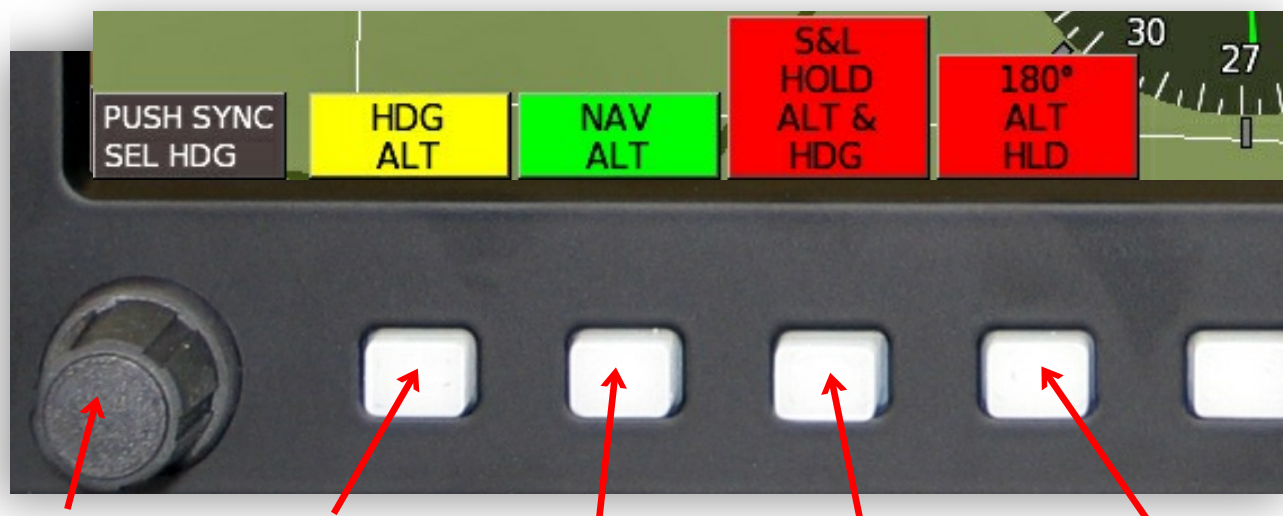
Climb/Descent Presets
Choose one of the displayed preset rates to execute the climb or descent.

Flight Director
Press to turn Flight Director on or off.

The **preset** airspeed or vertical speed choices change as vertical a/p modes change. In this example, an altitude was dialed in that is higher than current altitude, so these softkeys automatically display the default climb presets. If a lower altitude was dialed in, they would display descent rate presets. Alternatively, turn Right Knob to manually set a custom airspeed or vertical speed. See Autopilot Presets in this section for more information on programing and using vertical a/p presets. See Flight Director section for more information on how to use the **Flight Director**.

Engaging the Autopilot

1. Energize servo(s) by turning on servo power switch.
2. Press engage/disengage switch, typically located on control stick. **The aircraft will maintain present heading and pitch** and the softkeys illustrated below will appear.
3. **To engage the Emergency functions**, press the appropriate red softkey and adjust throttle setting as necessary to maintain level flight.
3. **To engage HDG/ALT function** (fly to and capture Heading and Altitude Bugs):
 - a. Enter desired altitude into Altitude Selection Box using the right knob;
 - b. Enter desired heading by turning or pressing the left knob to adjust Heading Bug;
 - c. Press yellow HDG/ALT softkey to fly to and capture heading and altitude bugs.
4. **To engage NAV/ALT function** (fly to and capture Navigation Course and Altitude Bug):
 - a. Enter desired altitude into Altitude Selection Box using right knob;
 - b. Intercept NAV radial or activate GPS flight plan
 - c. Press NAV/ALT softkey–This is GREEN if GPS is the active navigation and WHITE if VOR/LOC is active.



Left Knob:
Push to sync heading bug with current heading.
Turn to adjust heading bug.

HDG/ALT:
Follow selected heading and altitude. Set bugs before pressing.

NAV/ALT:
Press to fly to active **NAV** or **GPS** course and selected altitude. Set course and bugs before pressing.

S&L HOLD ALT & HDG:
Engages a/p to roll wings level, then pitch to hold present altitude. Unusual attitude recovery.

180° ALT HLD:
Press to hold present altitude and enter a 180 degree turn. For level exit from inadvertent IMC.

When the servos are powered on and A/P is engaged, use the following procedures from any HOME screen.

Follow a Heading

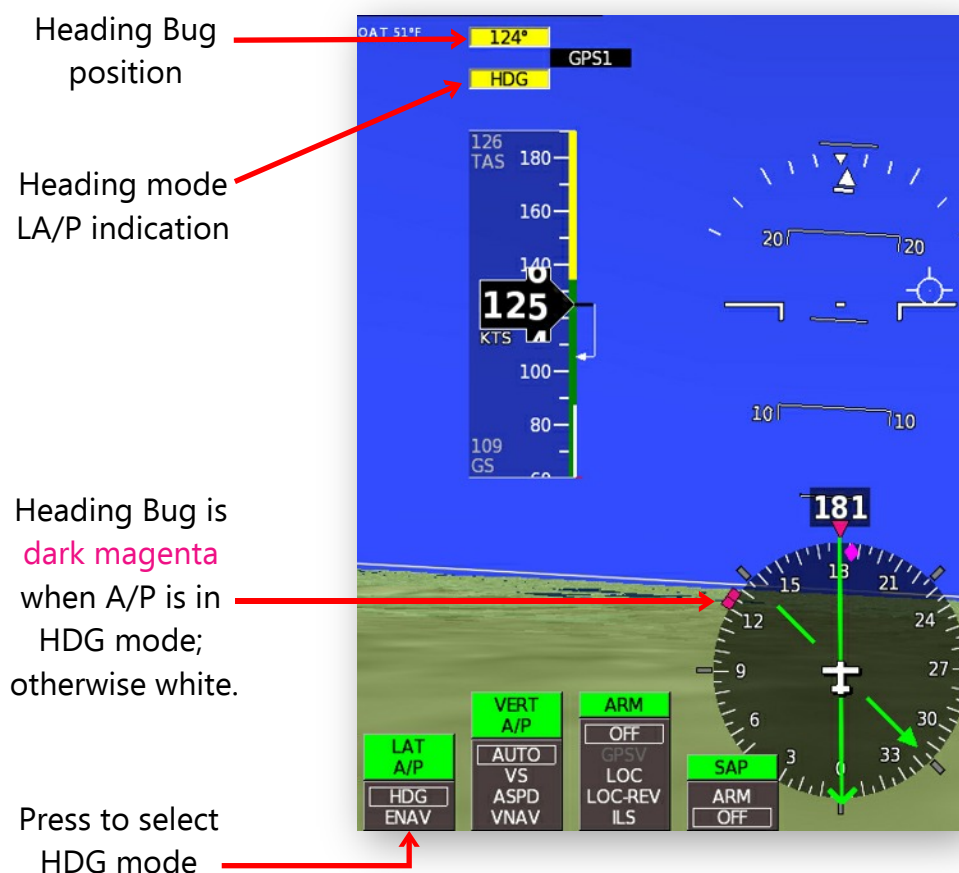
1. Turn Left Knob to adjust heading bug to desired heading; Or press Left Knob to set heading bug to current heading.

If LA/P is already in **HDG** mode, the aircraft will bank to follow the heading bug.

If A/P is in ENAV mode:

2. Press Right Knob to activate A/P softkeys.
3. Press LAT A/P softkey to highlight HDG. Press EXIT to engage and exit back to HOME screen. Autopilot will enter **HDG** MODE and follow the heading bug.
4. Adjust heading using the Left Knob to guide the aircraft using the heading bug, such as for ATC vectors.

⚡ **TIP:** The autopilot will always bank in the direction of the shortest distance to the selected heading. Make all heading bug adjustments that are more than 180 degrees in two or more smaller increments to "guide" it in the correct direction.

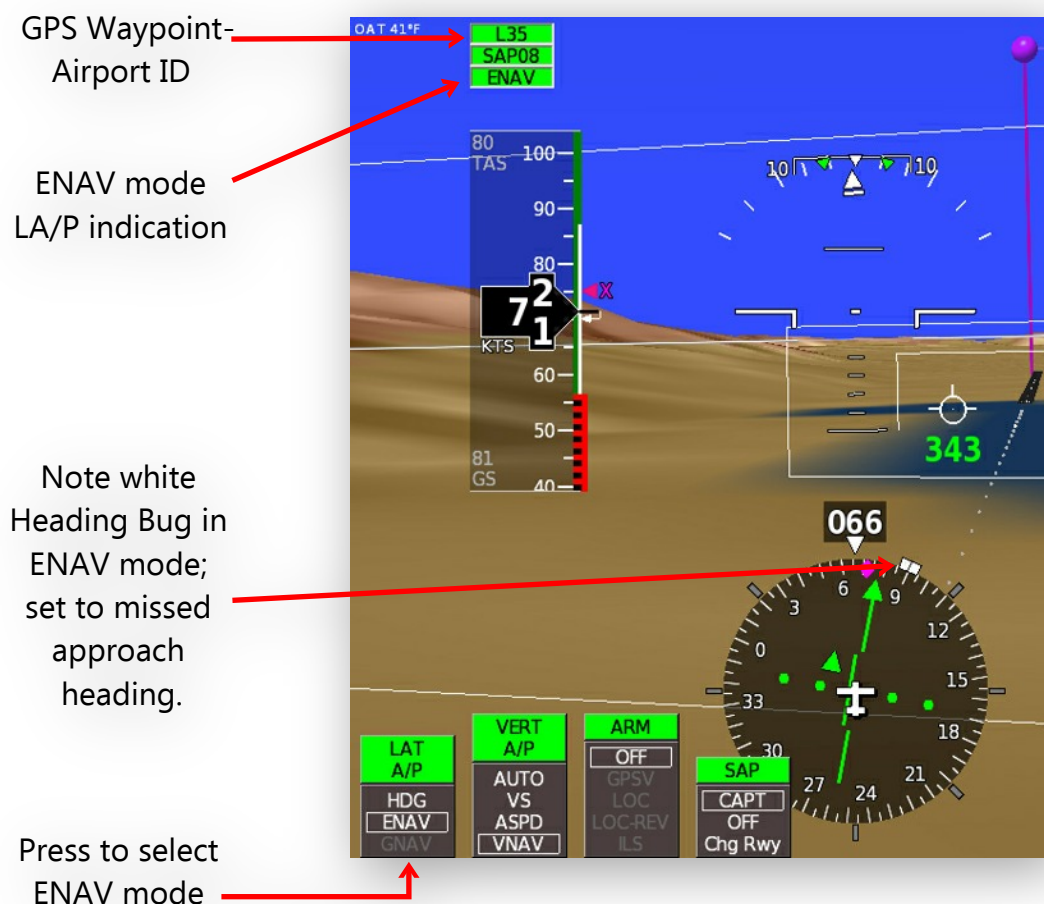


In this example, the heading bug is set to 124° and the Lateral A/P is engaged in heading mode. The aircraft is about to initiate a turn toward the heading bug. (Demo unit screenshot; The turn is instantaneous in actual flight.)

Track a GPS Course (Internal Flight Plan)

1. For best results, start off in HDG mode to avoid abrupt course changes when flight plan is activated.
1. Enter GPS waypoint(s) using a Direct-To or Sequence Mode, creating an [internal flight plan](#).
2. Press OBS/CDI softkey to activate Navigation Source selection softkeys.
3. Press softkey beneath the appropriate Nav Source (GPS1 or GPS2). **The source driving the autopilot is underlined in green.** **GPS1** (or 2) will appear in the LA/P Nav Source annunciator box. GPS course will appear as a Course Selection Needle on the HSI.
4. Press Right Knob to go to HOME page, then again to activate A/P menu.
5. If A/P is in **HDG** mode, press LAT A/P softkey to highlight ENAV. Press EXIT to engage and exit back to HOME screen. Autopilot will enter **ENAV** or EFIS Navigation mode and follow the GPS flight plan.

✓ **TIP:** For smooth operation, make sure the aircraft is on the GPS course before engaging ENAV mode, as it may roll rapidly to intercept the course.

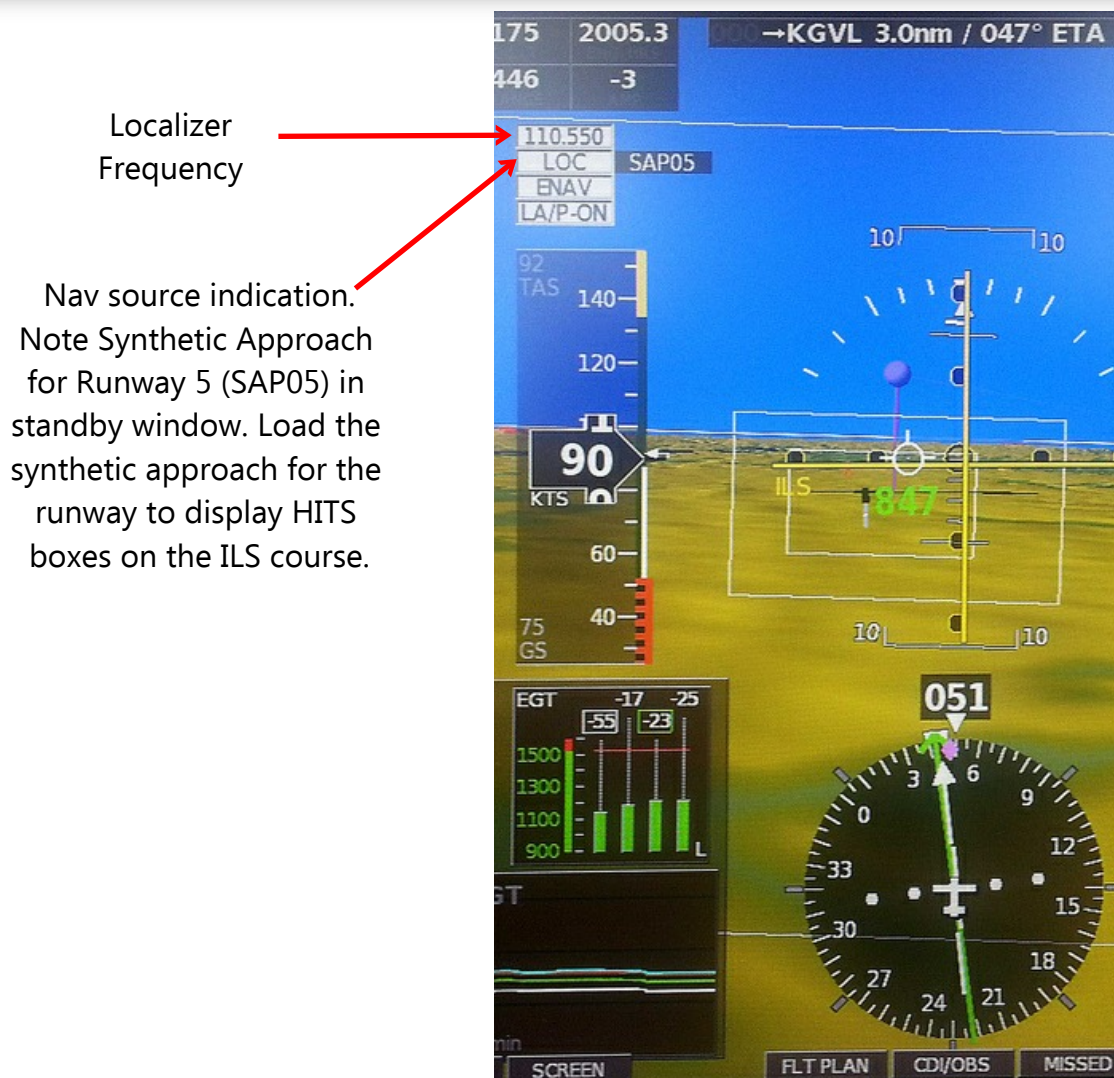


In this example, the LA/P is set for ENAV mode, following the synthetic approach for Runway 08 at Big Bear City, CA (L35).

Track a VOR/LOC Course

1. For best results, engage HDG mode of autopilot. (This will allow smooth adjustment of OBS course.)
2. Tune VOR or ILS frequency into the Nav radio.
3. Press OBS/CDI softkey to activate Navigation Source selection softkeys.
4. Press softkey beneath the Nav source to be tracked (NAV1, NAV2). For a VOR, adjust OBS course by turning Right Knob. ILS inbound courses are automatically tuned on the HSI.
5. Press Right Knob to return to Home, then press it again to access Autopilot control softkeys.
6. Press LAT A/P softkey to highlight ENAV. The autopilot will fly to and capture the selected radial. Note that the ILS CDI replaces the horizontal bars of the attitude indicator if the selected frequency is a localizer.

✓ **TIP:** For smooth operation, make sure the aircraft is on a shallow intercept course before engaging ENAV mode, as it may roll rapidly to intercept the course.



Setting Up the Presets

The HXR can store and recall preset airspeeds and rates for autopilot-coupled altitude changes. Customize your autopilot with 2 values for each of the following:

- Climb IAS
- Climb VS
- Descent IAS
- Descent VS

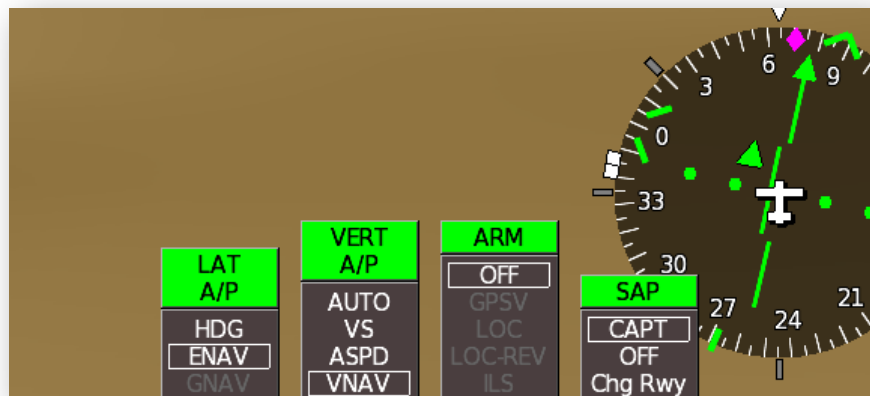
Before using the autopilot, set a gentle cruise climb/descent and a more aggressive rate for each.

1. Press MORE > Set Menu > Primary Flight Display
2. Scroll to **Climb IAS Preset #1** and begin entering speed/rate settings appropriate for your aircraft.
3. SAVE your settings.

Flying the Autopilot Using Presets

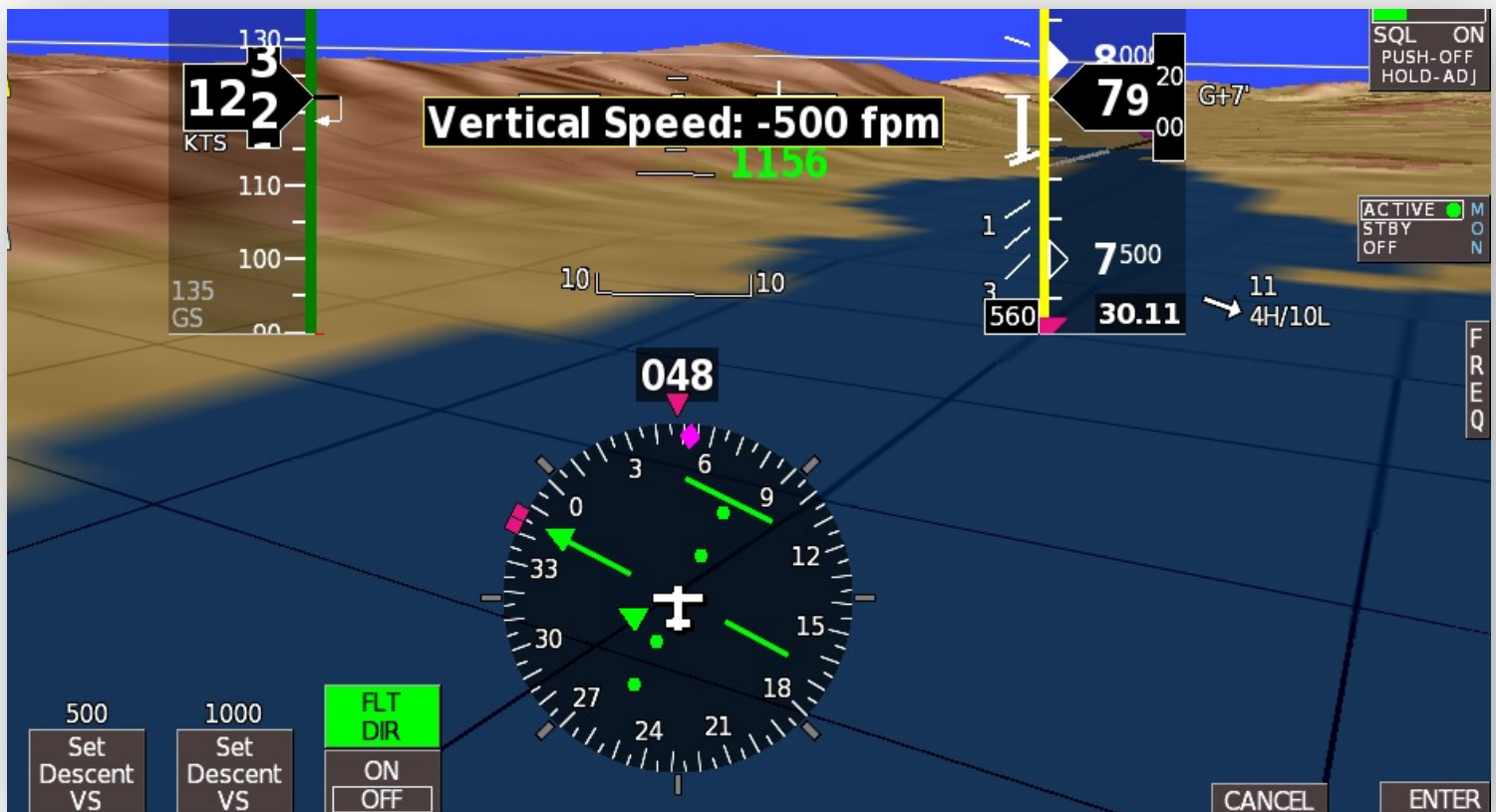
In flight, choose which presets to use during climbs and descents. The default setting, AUTO, presents airspeed (IAS) presets for climbs and Rate (VS) presets for descents. To change this:

1. From the HOME screen, press the right knob to access the autopilot softkeys shown below. Alternatively, turn the right knob, which will also begin the process of changing the altitude bug.
2. Press the VERT A/P softkey to manually select AUTO, VS (vertical speed), ASPD (airspeed), or VNAV (vertical navigation/approach).



To Climb/Descend With Autopilot Engaged:

1. From the HOME screen, turn the right knob to enter a new altitude into the Altitude Preselect Window/Altitude Bug.
2. Press the knob to set it.
3. If the new altitude is higher than the present altitude, a message will appear on the PFD screen asking if you would like to climb at the suggested (last used climb) airspeed. If the new altitude is lower, it will ask if you would like to descend at the suggested (last used descent) vertical speed. Then perform one of the following actions:
 - a. Press the right knob to accept the displayed airspeed/vertical speed and begin the altitude change.
 - b. Press one of the preset airspeed/vertical speed softkeys displayed on the bottom of the screen, then press the right knob to acknowledge and begin the altitude change.
 - c. Turn the right knob to set a any airspeed/vertical speed, then press it again to begin the altitude change.
 - d. Press CANCEL to abandon the altitude change and go back to the HOME screen softkeys.



Descent Rate Presets

Press Knob to Begin Altitude Change

The LA/P (lateral autopilot) annunciator fields appear on the PFD above the airspeed tape. The field labels are illustrated here, along with a color Example A.

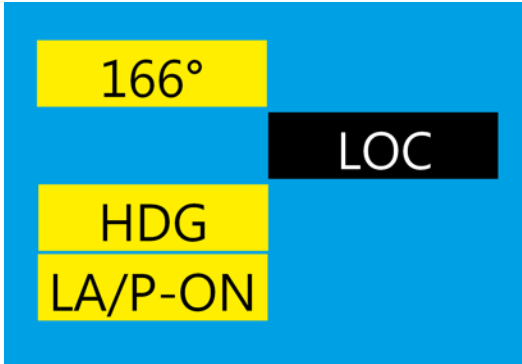
Annunciator Field Label Format

Target	
Navigation Source	
A/P Mode	
Servo Status	

Active
Column

Pending
Column

Example A



Lateral A/P Annunciator Fields and Possible Indications

Target

or "Steer-To." Where the lateral A/P is going. This can be a heading, GPS waypoint, airport identifier, VHF frequency, etc. Possible indications include:		
LA/P Mode	Indicator Example	Steer To:
HDG HLD	- - - °	No steer-to target is defined.
HDG	166°	Selected heading (166° in Example A above)
ENAV	KGRR	Active GPS Waypoint ID
	166°	Reversion to last GPS course after passing last waypoint in the flight plan
	119.1	VHF NAVAID frequency before ILS or VOR approach is armed
	GRR	VHF NAVAID frequency after ILS or VOR approach is armed

Navigation Source

The navigation source the A/P is tracking. This can be VOR, ILS, LOC, GPS, or SAP (synthetic approach). Synthetic Approach indication will also display the runway number. Inactive or armed nav source labels in the Pending column are black with white lettering. If a Nav source is selected on the OBS/Nav Source page but the A/P is in heading mode, that source will appear in the Pending column.

LA/P Mode	Indicator Example	Lateral A/P is tracking:
HDG	LOC	(Pending column only) Armed approach activates when aircraft is in range; LA/P mode automatically switches to ENAV when approach is captured.
ENAV	LOC	VHF NAVAID (can also be VOR or ILS).
	SAP05	Lateral portion of GPS-derived Synthetic Approach. Note runway designation. (This example is SAP for Runway 5.)
	GPS1	Flight plan or Direct-To GPS course
	LPV	GPS LPV precision approach
any mode	GS Lost	VHF signal lost during approach. Appropriate label is displayed for each flagged or inop VHF component (GS, LOC, VOR, etc). Displays in Pending column.
	GPS1 Lost	GPS signal lost. Displays in Pending column.

LA/P Mode

Indicates lateral command mode.

LA/P Mode	Indicator Example	Lateral A/P mode definitions are:
—	HDG HLD	Heading Hold- Holds current heading upon a/p engagement.
HDG	HDG	Heading Mode. A/P follows Heading Bug.
ENAV	ENAV	"EFIS Navigation." A/P follows active GPS course (Internal Flight Plan).
	ENAV	"EFIS Navigation." A/P follows active VHF course as displayed on EFIS.
	CRS	Mode is ENAV but no valid GPS flight plan or VHF course exists. A/P holds last known course track, which can be adjusted using right knob (OBS) when CDI/OBS menu is activated.
GNAV	GNAV	GPS Navigation (meaning External GPS, or "not" the EFIS). This is a "pass-through" mode in which a connected external GPS navigator controls the autopilot directly using an External Flight Plan.

Servo Status

Indicates servo activation level.

LA/P Mode	Indicator Example	Servo power & activation:
none	LA/P-OFF	Power to the servo is disconnected. Emergency modes unavailable.
any	LA/P-ON	Servo is powered, communicating with the EFIS; LA/P is engaged.
none	LA/P-Stby	Servo powered & communicating; LA/P NOT engaged. Pending only.

The VA/P (vertical autopilot) annunciator fields appear on the PFD above the altimeter tape. The field labels are illustrated here, along with a color Example B.

In Example B, the altitude bug is set for 7500 feet, the a/p is in Altitude Hold mode at 7500 feet, and Vertical a/p is engaged. An ILS approach has been armed (glideslope intercept is pending).

Annunciator Field Label Format

	Target Altitude
	Vertical Navigation Source
	A/P Mode
	Servo Status

Pending Column

Active Column



Example B



Vertical A/P Annunciator Fields and Possible Indicators

Target Altitude

Where the vertical A/P is going, MSL altitude. In VNAV mode, this field contains Decision Altitude if one has been specified. (Warning: A/P will NOT level off at Decision Altitude—it is just a reminder.)		
VA/P Mode	Indicator Example	Steer To:
any mode	- - - -	Dashes- No altitude target is defined. Color corresponds to Nav source.
any mode	7500	Altitude Bug/Target (7,500 feet in Example A above)

Vertical Autopilot Annunciators (continued)

Vertical Nav Source

Present when pilot has armed or activated a precision approach or synthetic approach. Indicators are black with white text when they are in the "Pending" column.

VA/P Mode	Indicator	Autopilot is following:
VNAV	G/S	ILS Glideslope (Nav 1).
	LPV	LPV precision GPS approach
	SAP08	Synthetic Approach with runway designation (Runway 08 in this example)
	G/S-2	ILS Glideslope (Nav 2)

Vertical A/P Mode

Indicates whether vertical A/P is engaged and how it is controlling the airplane.

VA/P Mode	Indicator	Vertical Autopilot mode is:
–	PIT HLD	Pitch Hold; Holds current pitch upon a/p engagement
VS	VS HLD	Vertical Speed Hold mode; holds present vertical speed indefinitely.
	VS-500	VS or Vertical Speed mode; Climbs/descends at specified rate (500 fpm in this example).
ASPD	IAS- 125	ASPD or Airspeed mode; Climbs/descends at specified indicated airspeed. (125 knots in this example)
any mode	ALT HLD	Altitude Hold- Holds altitude specified in Target Altitude field
VNAV	VNAV	Vertical Navigation; A/P following vertical glideslope. Color specifies type of navigation- Green=GPS, White=VHF glideslope 1, Cyan=VHF glideslope 2
any mode	SUSP	Suspend; Pitch servo disengaged because of excessive roll angle.

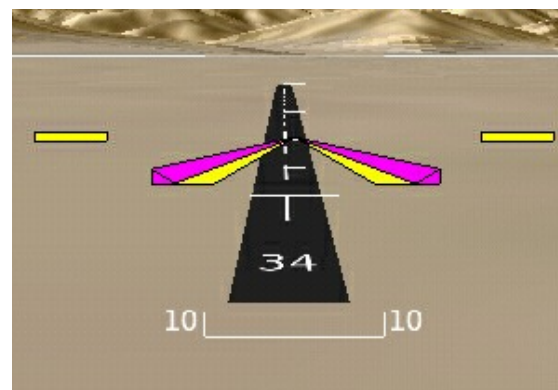
Servo Status

Indicates servo activation level.

VA/P Mode	Indicator	Servo status is:
none	VA/P-OFF	Power to the servo is disconnected. Emergency modes unavailable.
any	VA/P-ON	Servo is powered, communicating with the EFIS and VA/P is engaged. Yellow when not following specified course/altitude.
none	VA/P-Stby	Servo powered & communicating; VA/P NOT engaged. Pending only.

Every GRT EFIS with vertical autopilot software is capable of displaying a Flight Director. Commercial pilots may recognize it as a tool for precise hand-flying that's commonly found in larger aircraft. It is a visual indication of the same commands that the autopilot would follow to guide the airplane. Pilots who use the flight director report less fatigue during instrument conditions while hand flying because the computer does much of the instrument interpretation for you.

The concept is simple: Follow the magenta command bars. When the flight director is activated, the yellow horizontal bars and small chevron replace the wing/nose of the attitude indicator. The larger magenta chevron represents the pitch and bank angle required to achieve the heading/course and climb/descent profile entered into the system. Use the flight controls to nest the yellow chevron into the magenta one. If they are aligned, you are right where the computer says you should be. Note that upon activation, any active VOR/ILS needles will be replaced with scales to make room.



In the example above, the flight director command bars are properly aligned and the pilot is on glidepath. In the example at right, the magenta command bar is calling for a descending left bank.

To enable the Flight Director feature:

Enable both the Lateral and Vertical autopilot functions in the General Setup menu. The flight director is controlled by the autopilot functions even if you don't have an autopilot.

To use the Flight Director:

Press the right EFIS knob once to access the autopilot controls. Adjust the settings as necessary to set up the vertical and lateral navigation profile you would like to fly. For example, if the LAT A/P is set for HDG mode, the flight director will follow the heading bug. If the vertical autopilot is set up to capture a glideslope, the flight director will capture and follow it.



From the PFD page, press the right EFIS knob twice. This brings up the second tier of autopilot controls. Press FLT DIR softkey to highlight ON. The flight director will indicate pitch and roll as necessary to capture the selected settings. Follow it using the flight controls. Remember to use throttle as necessary to maintain safe airspeeds.

To quit using the flight director, press the right knob twice from the PFD page and highlight OFF with the FLT DIR softkey.